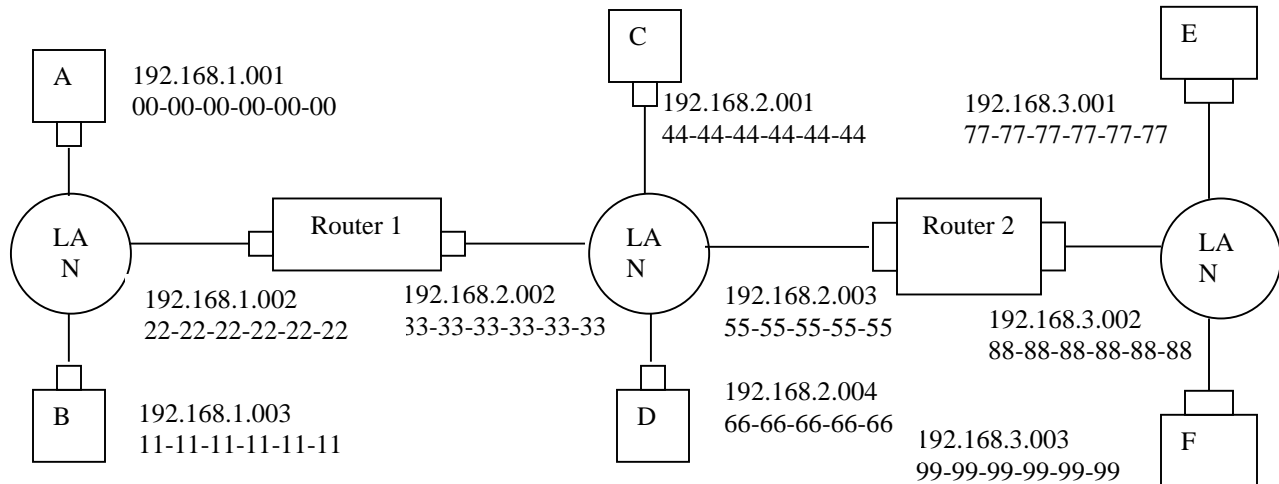


Problem 14

a), b) See figure below.



c)

1. Forwarding table in E determines that the datagram should be routed to interface 192.168.3.002.
2. The adapter in E creates an Ethernet packet with Ethernet destination address 88-88-88-88-88-88.
3. Router 2 receives the packet and extracts the datagram. The forwarding table in this router indicates that the datagram is to be routed to 192.168.2.002.
4. Router 2 then sends the Ethernet packet with the destination address of 33-33-33-33-33-33 and source address of 55-55-55-55-55-55 via its interface with IP address of 192.168.2.003.
5. The process continues until the packet has reached Host B.

a) ARP in E must now determine the MAC address of 192.168.3.002. Host E sends out an ARP query packet within a broadcast Ethernet frame. Router 2 receives the query packet and sends to Host E an ARP response packet. This ARP response packet is carried by an Ethernet frame with Ethernet destination address 77-77-77-77-77-77.

Problem 15

a) No. E can check the subnet prefix of Host F's IP address, and then learn that F is on the same LAN. Thus, E will not send the packet to the default router R1.

Ethernet frame from E to F:

Source IP = E's IP address

Destination IP = F's IP address

Source MAC = E's MAC address

Destination MAC = F's MAC address

- b) No, because they are not on the same LAN. E can find this out by checking B's IP address.

Ethernet frame from E to R1:

Source IP = E's IP address

Destination IP = B's IP address

Source MAC = E's MAC address

Destination MAC = The MAC address of R1's interface connecting to Subnet 3.

- c) Switch S1 will broadcast the Ethernet frame via both its interfaces as the received ARP frame's destination address is a broadcast address. And it learns that A resides on Subnet 1 which is connected to S1 at the interface connecting to Subnet 1. And, S1 will update its forwarding table to include an entry for Host A.

Yes, router R1 also receives this ARP request message, but R1 won't forward the message to Subnet 3.

B won't send ARP query message asking for A's MAC address, as this address can be obtained from A's query message.

Once switch S1 receives B's response message, it will add an entry for host B in its forwarding table, and then drop the received frame as destination host A is on the same interface as host B (i.e., A and B are on the same LAN segment).

Problem 22

- i) from A to switch: Source MAC address: 00-00-00-00-00-00
Destination MAC address: 55-55-55-55-55-55
Source IP: 111.111.111.001
Destination IP: 133.333.333.003
- ii) from switch to right router: Source MAC address: 00-00-00-00-00-00
Destination MAC address: 55-55-55-55-55-55
Source IP: 111.111.111.001
Destination IP: 133.333.333.003
- iii) from right router to F: Source MAC address: 88-88-88-88-88-88
Destination MAC address: 99-99-99-99-99-99
Source IP: 111.111.111.001
Destination IP: 133.333.333.003

Problem 26

Action	Switch Table State	Link(s) packet is forwarded to	Explanation
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B sends a frame to E	Switch learns interface corresponding to MAC address of B	A, C, D, E, and F	Since switch table is empty, so switch does not know the interface corresponding to MAC address of E
E replies with a frame to B	Switch learns interface corresponding to MAC address of E	B	Since switch already knows interface corresponding to MAC address of B
A sends a frame to B	Switch learns the interface corresponding to MAC address of A	B	Since switch already knows the interface corresponding to MAC address of B
B replies with a frame to A	Switch table state remains the same as before	A	Since switch already knows the interface corresponding to MAC address of A

Problem 31

(The following description is short, but contains all major key steps and key protocols involved.)

Your computer first uses DHCP to obtain an IP address. Your computer first creates a special IP datagram destined to 255.255.255.255 in the DHCP server discovery step, and puts it in an Ethernet frame and broadcasts it in the Ethernet. Then following the steps in the DHCP protocol, your computer is able to get an IP address with a given lease time.

A DHCP server on the Ethernet also gives your computer a list of IP addresses of first-hop routers, the subnet mask of the subnet where your computer resides, and the addresses of local DNS servers (if they exist).

Since your computer's ARP cache is initially empty, your computer will use ARP protocol to get the MAC addresses of the first-hop router and the local DNS server.

Your computer first will get the IP address of the Web page you would like to download. If the local DNS server does not have the IP address, then your computer will use DNS protocol to find the IP address of the Web page.

Once your computer has the IP address of the Web page, then it will send out the HTTP request via the first-hop router if the Web page does not reside in a local Web server. The HTTP request message will be segmented and encapsulated into TCP packets, and then further encapsulated into IP packets, and finally encapsulated into Ethernet frames. Your computer sends the Ethernet frames destined to the first-hop router. Once the router receives the frames, it passes them up into

IP layer, checks its routing table, and then sends the packets to the right interface out of all of its interfaces.

Then your IP packets will be routed through the Internet until they reach the Web server.

The server hosting the Web page will send back the Web page to your computer via HTTP response messages. Those messages will be encapsulated into TCP packets and then further into IP packets. Those IP packets follow IP routes and finally reach your first-hop router, and then the router will forward those IP packets to your computer by encapsulating them into Ethernet frames.

Problem 6

Suppose that wireless station H1 has 1000 long frames to transmit. (H1 may be an AP that is forwarding an MP3 to some other wireless station.) Suppose initially H1 is the only station that wants to transmit, but that while half-way through transmitting its first frame, H2 wants to transmit a frame. For simplicity, also suppose every station can hear every other station's signal (that is, no hidden terminals). Before transmitting, H2 will sense that the channel is busy, and therefore choose a random backoff value.

Now suppose that after sending its first frame, H1 returns to step 1; that is, it waits a short period of times (DIFS) and then starts to transmit the second frame. H1's second frame will then be transmitted while H2 is stuck in backoff, waiting for an idle channel. Thus, H1 should get to transmit all of its 1000 frames before H2 has a chance to access the channel. On the other hand, if H1 goes to step 2 after transmitting a frame, then it too chooses a random backoff value, thereby giving a fair chance to H2. Thus, fairness was the rationale behind this design choice.